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AIR POWERED ENGINE

Pramod Kumar .J
Mechanical Engineer, Bangalore, INDIAs

ABSTRACT

The environmental pollution in the metropolitan cities is increasing rapidly mostly because of the increased number of fossil fuel powered vehicles. Many alternative options are now being studied throughout the world. One of the alternative solutions can be a compressed air powered vehicle. Main advantage of this engine is that no hydrocarbon fuel is required which means no combustion process is taking place.

In this project, an SI engine is converted into a compressed air engine. A four stroke single cylinder SI engine is converted to two stroke engine which operates using compressed air because of its design simplicity. As we converted the already existing conventional engine into an air powered one, this new technology is easy to adapt. Another benefit is that it uses air as fuel which is available abundantly in atmosphere.

Key words: Air Powered Engine, Compressed Air, Rope Brake Dynamometer

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INTRODUCTION

Today fossil fuels are widely used as a source of energy in various fields like power plants, internal combustion engine, external combustion engines, as a heat source in manufacturing industries, etc. But due to limited stock and excessive use, fossil fuels are depleting at rapid rate. Therefore it is inevitable to develop alternate technologies in order to use renewable energy sources, so that fossil fuels can be conserved.

One of the major fields in which fossil fuels are used is Internal Combustion Engine. An alternative of IC Engine is "**Air Powered Engine**". It is an engine which will use compressed air to run the engine. It is cheap as it uses air as fuel, which is available abundantly in atmosphere.

There are several technical benefits of using this engine, like no combustion takes place inside the cylinder, working temperature of engine is very close to ambient temperature. This helps in reducing wear and tear of the engine components. Also there is no possibility of knocking. This in turn results in smooth working of engine. Additional technical benefits are that there will be no need for installing cooling system or complex fuel injection systems. This makes the design simpler. Also, as

discussed earlier, as no combustion takes place which results in smooth working of the engine with minimum wear and tear, this will require less maintenance.

With the exhaust temperature of the engine being slightly less than the atmospheric temperature (i.e. 15-25degc) it will help in cooling the environment. Exhaust gases leaving the engine will be only air having low temperature. This will eliminate the problem of harmful emissions, in conventional engines.

OBJECTIVE

1. Modification of **I.C. Engine** into an Air Powered Engine.
2. To develop an Engine that has almost zero emissions**.**
3. Designing our own test rig.
4. Testing of the Engine on the built test rig.

BASIC PRINCIPLE

The principle behind the working of the Air powered Engine is the ability of air to store energy on compression and then release the same on expansion. On compression, the work done by the pump gets stored as pressure energy. This compressed air is then stored in cylinders/tanks for later use. When this air is allowed to expand, the pressure energy of air gets converted to kinetic energy and causes propulsion. The same principle is used for engines. A **throttling mechanism** is attached to the cylinder opening valve from the throttle. When the required rotation is provided to the throttle, the valve opens to a particular degree controlling the amount of air delivered out. This air is delivered to the engine. When the compressed air enters the engine through the inlet valve it strikes the piston, which moves (reciprocate) causing first half rotation of the crank shaft, this striked air gets expanded which then moves to the out through the outlet during the 2^{nd} half rotation of the crank shaft . The air is stored either in cylinder or compressor. The sole purpose of storing air at such high pressure is to ensure that there is enough volume of air present in the vehicle to allow it to run for a long period of time before having to refill the cylinder. The working of the engine is as shown in the fig 3.1 and 3.2.

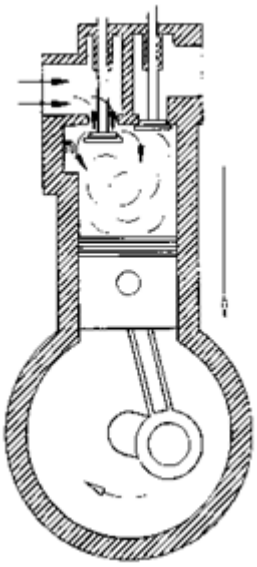

Figure 3.1 Working 1^{st} half rotation of crank shaft

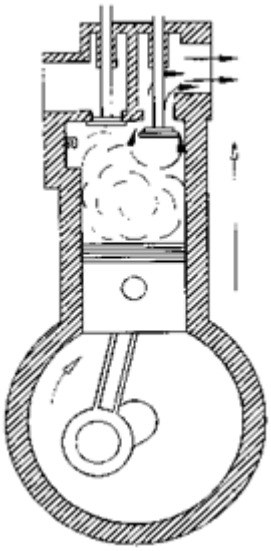

Figure 3.2 Working of 2nd Half Rotation of Crank Shaft

ROPE BRAKE DYNAMOMETER

For the analysis of the engine, of various measurement parameters was required, to fulfill this requirement a custom made rope brake dynamometer was fabricated. Here for the fabrication of the dynamometer, a pulley, a shaft, a sprocket with 13tooth, and a spring balance was required. The shaft was inserted into the pulley and tight fitted using a hydraulic press. Then the bearing was inserted into the shaft for support and free rotation of the shaft. Turning process was performed on the shaft in the lathe machine in order to machine it to fit the sprocket. The sprocket was then inserted into the shaft and arc welded to the shaft. This structure was then fixed on a support structure with two bearings for support and free rotation.

PROCEDURE

In a rope brake dynamometer a rope is wrapped over the rime of a pulley keyed to the shaft of the engine. The diameter of the rope depends upon the power of the machine. The upper end of a rope is attached to the spring balance whereas the lower end supports the weight of suspended mass.

- The drive sprocket of the engine was connected to a similar drive sprocket of the drum shaft through chain drive.
- Dead weights varying from up to 5 kg were used for the experiment. The dead weights were in 1 kg and 2 kg denomination.
- A particular weight was fixed to the end of the rope attached to the spring balance.
- When the engine was started, its drive sprocket rotated the dynamometer's drum shaft through its chain drive which was in turn connected to the sprocket.
- The Engine was started when the pressurized air was at 7.5 bar and at 1st gear.
- RPM and Spring Balance were taken for every 0.5 bar decrease in pressure.

CALCULATION

- Speed of the dynamometer shaft was based on the readings obtained from Tachometer
- Torque developed in engine was based on the formulation $T = (9.81 \times W \times R)$
    - T – Torque (N-m)
    - W – mass added (Kg)
    - R – Radius of the Brake drum (meters)
- Brake Power of the Engine was based on $B.P = (2 \times \pi \times N \times T)/60{,}000$
    - B.P – Brake Power (KW)
    - N – speed of rotation (rpm)
    - T – Torque (N-m)

Tabular Column

Pressure (bar)	**Speed (in rpm)**			
	1ST GEAR	**2ND GEAR**	**3RD GEAR**	**4TH GEAR**
8	230	620	780	810
7.5	235	622	830	970
7	305	580	830	1010

Pressure (Bar)	**Speed (rpm in 100)**	**Torque (N-m)**	**Brake Power (B.P in 100 W)**
7	2.7	4.077	1.152
6.5	2.4	3.8626	0.9705
6	2	3.0043	0.629

A Proved fact:

"Research by MDI shows that an Air Powered Car can travel 171 km by using electricity costing about Rs. 80-100 which would cost about Rs.570 for a normal S.I. engine car giving an average of 15 kmpl."

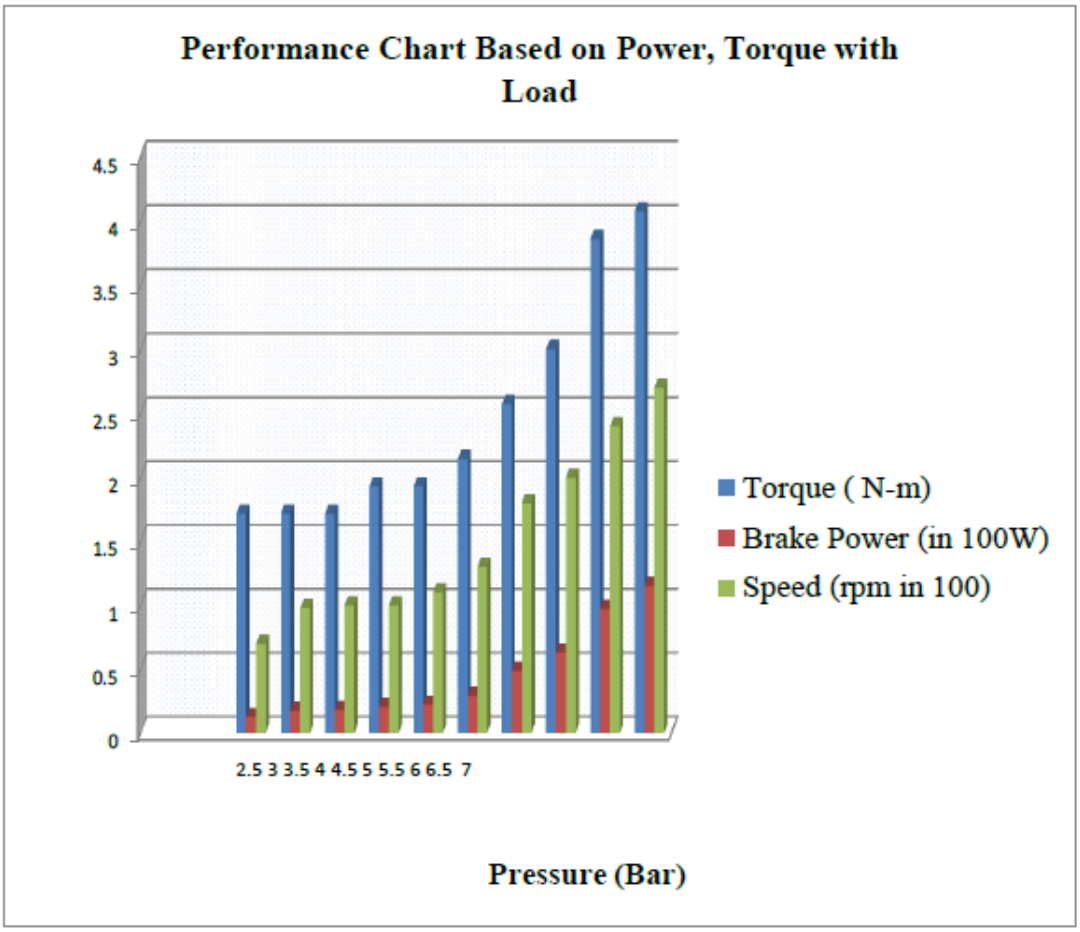

Fig: Graph Showing the Torque, Speed & B.P

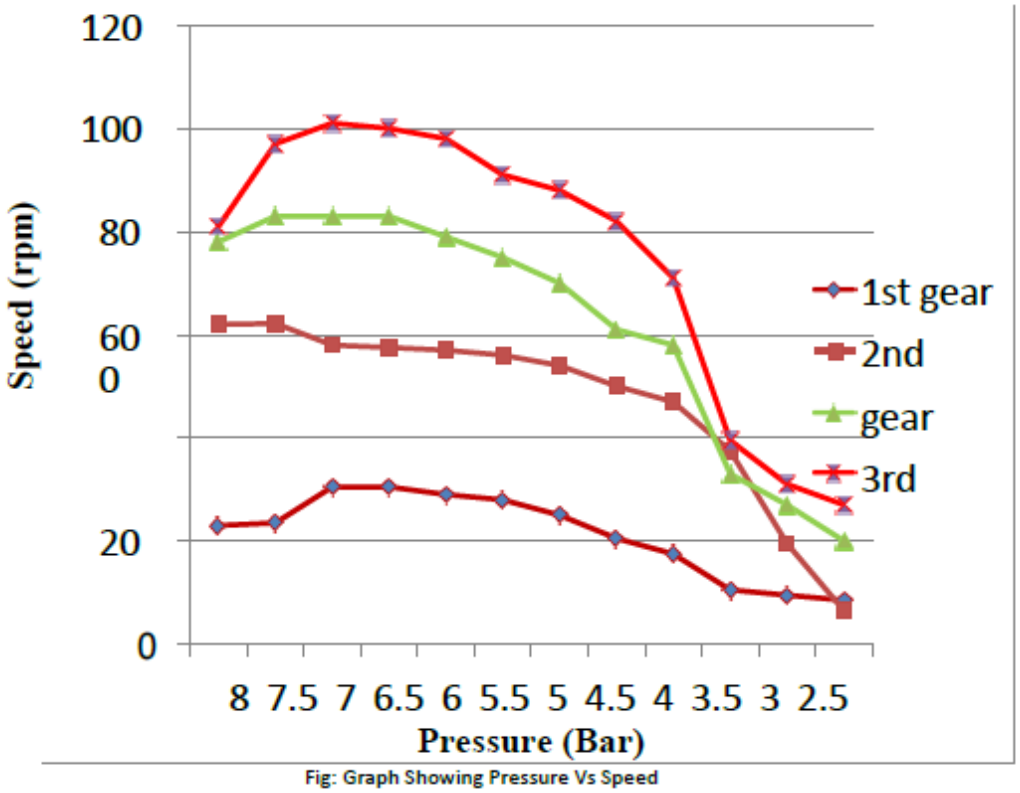

Fig: Graph Showing Pressure Vs Speed

ADVANTAGES

Technical Benefits

- The temperature of the engine while working will be slightly less than the ambient temperature.
- Smooth working of the engine due to very less wear and tear of the components.
- There is no possibility of knocking.
- No need of cooling systems and spark plugs or complex fuel injection systems.
- The engine runs on cold or warm air, so can be made of lower strength light weight material such as aluminum, plastic, low friction Teflon or a combination.

Economic Benefits

- No use of expensive fossil fuels as the free air is compressed and taken to use.
- For this reason people can easily shift to the new technology.
- Compressors use electricity for generating compressed air which is relatively much cheaper and widespread.
- Smooth working will lead to less wear & tear, so lesser maintenance cost.
- Compressed-air technology reduces the cost of vehicle production by about 20%, because there is no need to build a cooling system, fuel tank, Ignition Systems or silencers.
- Low manufacture and maintenance costs as well as easy maintenance.
- Lighter vehicles cause less damage to roads, resulting in lower maintenance cost.

SCOPE FOR FUTURE WORK

As there is no combustion use of lighter engine parts like carbon fiber for piston and connecting rod will give more efficiency as the inertia will decrease.

Reduction of diameter of piston improves volumetric efficiency.

Use of cam less inlet and outlet valves improve efficiency as the part of output power use to run cams through chain drives will not be needed.

An all-new technology combining Gasoline internal combustion engine and compressed air storage can be developed. It is developing this vehicle in response to the global need for energy efficient vehicles.

Focus on the development of air motor technology based on a unique rotary piston concept can be developed. The Engine air motor can be invented which would virtually eliminate vibration, internal wear and friction, in order to obtain superior performance for a wide variety of applications.

Air-compressed vehicle can be developed with high performance which would run only on compressed air.

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